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PROTECTING ENDANGERED SPECIES WITHOUT REGULATING PRIVATE LANDOWNERS: THE CASE OF ENDANGERED PLANTS

Jeffrey J. Rachlinski†

Few areas of environmental law have inspired as much criticism as the Federal Endangered Species Act ("ESA").¹ One of the principal criticisms of the ESA is that, like most of the United States' environmental laws, the ESA adopts a command and control approach to environmental regulation. Command and control regulations define specific measures that regulated entities must undertake, regardless of whether such measures are the most effective means of improving environmental quality. Conventional wisdom is forming in environmental law that such regulations are wasteful.² Command and control regulations over-regulate harmless activities, under-regulate harmful activities,³ and can even undermine the goals they purport to advance.⁴ In the case of the ESA, its restrictions on private landowners are command and control regulations. The ESA prohibits private landowners from altering the habitat of some endangered species, thereby preventing these landowners from engaging in activities such as logging, building housing, and farming. The ESA imposes this restriction for all animal species, regardless of the cost or the benefits of doing so.

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¹ 16 U.S.C. §§ 1530-44 (1994).

² See generally PRESIDENT'S COUNCIL ON SUSTAINABLE DEVELOPMENT, *SUSTAINABLE AMERICA: A NEW CONSENSUS FOR PROSPERITY, OPPORTUNITY, AND A HEALTHY ENVIRONMENT FOR THE FUTURE* (1996) (calling for greater flexibility and use of market forces in environmental regulation); Cass Sunstein, *Congress, Constitutional Moments, and the Cost-Benefit State*, 48 STAN. L. REV. 247, 260-61, 267-68 (1996) (also calling for regulatory flexibility).

³ See generally Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171 (1988) (arguing that command and control regulations are wasteful); but see Howard A. Latin, *Ideal Versus Real Regulatory Efficiency: Implementation of Uniform Standards and "Fine-Tuning" Regulatory Reforms*, 37 STAN. L. REV. 1267, 1267-72 (1985) (summarizing and responding to some of these criticisms).

⁴ See, e.g., BRUCE ACKERMAN & WILLIAM T. HASSLER, *CLEAN COAL/DIRTY AIR: OR HOW THE CLEAN AIR ACT BECAME A MULTIBILLION-DOLLAR BAIL-OUT FOR THE HIGH SULFUR COAL PRODUCERS AND WHAT SHOULD BE DONE ABOUT IT* (1981).

Both proponents and opponents of conserving endangered species cite the ESA's restrictions on private parties as its principal deficiency.⁵ Critics of the ESA argue that the restrictions are unfair to landowners and convert them from potential allies of endangered species into potential enemies. These restrictions arguably encourage landowners to ensure that no protected species ever sets foot on their property, or if one does, to "shoot, shovel, and shut up."⁶ Critics of the ESA also contend that many private landowners would voluntarily conserve species on their property but for the prospect of regulation by the federal government.⁷ The critics conclude from this analysis that this aspect of the ESA should be eliminated.⁸

Eliminating the ESA's restrictions on private landowners would likely produce one of two effects: it would either benefit endangered species or harm them. Because lifting these restrictions would make harboring endangered species less costly to landowners, it might inspire them to preserve important habitat voluntarily, thereby benefitting these species. Proponents of this reform, however, might be overstating landowners' affinity for protecting endangered species. If landowners actually have little regard for endangered species, then eliminating the ESA's restrictions would produce the opposite effect; such reform would free landowners to destroy habitat needed for the survival of endangered species.

Conducting the ideal experiment to determine which is the most likely of these two outcomes would be impossible. Nevertheless, an imperfect experiment is already underway. This experiment is the inadvertent result of the combination of two seldom-noticed aspects of endangered species protection in the United States. First, the ESA's restrictions on private landowners apply only to animal species, not plant species. Second, many states have adopted their own laws designed to protect endangered species. In some of these states, the presence of endangered plants on private land does restrict the landowners' activities.⁹ The resulting disparity in the laws of different states creates a natural

⁵ See CHARLES C. MANN & MARK L. PLUMMER, *NOAH'S CHOICE: THE FUTURE OF ENDANGERED SPECIES* (1995); DAVID S. WILCOVE ET AL., *REBUILDING THE ARK: TOWARD A MORE EFFECTIVE ENDANGERED SPECIES ACT* (1996); Richard A. Epstein, *Babbitt v. Sweet Home Chapters of Oregon: The Law and Economics of Habitat Preservation*, 5 SUP. CT. ECON. REV. 1 (1997); Stephen Polasky et al., *Endangered Species Conservation on Private Land*, 15 CONTEMP. ECON. POL'Y 66 (1997); Richard L. Stroup, *The Economics of Compensating Property Owners*, 15 CONTEMP. ECON. POL'Y 55 (1997).

⁶ H. Jane Lehman, *Skirmishes Carry Over Into Courtroom Series: Whose Land Is It? The Final Part of a Three-Part Series on the Private-Property Rights Movement in the U.S.*, CHI. TRIB., Feb. 2, 1992, at Real Estate 1.

⁷ See, e.g., WILCOVE ET AL., *supra* note 5.

⁸ See MANN & PLUMMER, *supra* note 5; Epstein, *supra* note 5; Stroup, *supra* note 5.

⁹ See *infra* notes 55-66 and accompanying text.

experiment that tests whether regulations restricting landowners harm or help endangered species.

The analysis in this paper uses data from the United States Fish and Wildlife Service ("FWS") to determine the outcome of this experiment. Briefly stated, the analysis shows that plants that depend on private property for their habitat do not fare well, and they fare much worse in those states that do not restrict private landowners. Even if the ESA's restrictions create some incentives for landowners to destroy the habitat of endangered species, the analysis in this paper suggests that these restrictions benefit endangered species overall. Giving private landowners unconstrained freedom to destroy habitat does not inspire voluntary efforts that save species. Rather, it reduces species viability. The ESA's goal of "conserv[ing] . . . endangered . . . and threatened species"¹⁰ might be accomplished with a method that is fairer or more cost-effective than restrictions on private landowners, but these restrictions further this goal.

Part I of this paper briefly describes the ESA, along with the critiques of the ESA's land-use restrictions. Part II elaborates on the law of endangered species protection as it applies to plants. Part III describes the methodology and results of the empirical analysis of the laws protecting plants. Finally, part IV briefly discusses the implications of the analysis.

I. THE FEDERAL ENDANGERED SPECIES ACT

A. THE REGULATORY ENVIRONMENT UNDER THE ESA

The FWS has primary responsibility for implementing the ESA.¹¹ The ESA charges the FWS with identifying those species that need its protection because they are either endangered ("in imminent danger of extinction") or threatened ("likely to become an endangered species within the foreseeable future").¹² For all species that the FWS identifies as endangered or threatened ("listed" species), the FWS must draft and implement a recovery plan designed to facilitate species recovery so that

¹⁰ 16 U.S.C. § 1531(b) (1994).

¹¹ The National Marine Fisheries Service ("NMFS"), rather than the FWS, has authority over marine species. The NMFS and the FWS share jurisdiction over anadromous fish, which live in both marine and freshwater environments. As this paper is concerned with private landowners and plants, those species under the exclusive jurisdiction of the NMFS are excluded from the discussion and the empirical analysis.

¹² 16 U.S.C. § 1532(6), (20) (1994). The list of endangered and threatened animals is found at Endangered and Threatened Wildlife, 50 C.F.R. § 17.11 (1998); and the list of endangered and threatened plants is found at Endangered and Threatened Plants, 50 C.F.R. § 17.12 (1998).

the species no longer needs the ESA's protection.¹³ The ESA also authorizes the FWS to purchase habitat for listed species.¹⁴

Listed species also obtain important protection against being harmed by the activities of other federal agencies. The ESA forbids any agency of the federal government from taking any action that is "likely to jeopardize the continued existence of any [listed] species."¹⁵ In addition, no federal agency may take any action that would "result in the destruction or adverse modification of habitat of such [listed] species determined by [the FWS] . . . to be critical."¹⁶ Finally, federal agencies are supposed to carry "out programs for the conservation of [listed] species."¹⁷

The ESA also imposes restrictions on private parties. These restrictions vary between plants and animals in important ways, but some restrictions apply to both. The ESA forbids the import, export, shipment in interstate commerce, or commercial sale of any listed plant or animal species.¹⁸ The most controversial aspect of the ESA, however, applies only to animals. The ESA makes it a crime to "take" any listed species of fish or wildlife.¹⁹ The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or attempt to engage in any such conduct."²⁰ Since 1975, the FWS's definition of "harm" has also included any "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."²¹ In order to avoid "adverse modification" of habitat, a private landowner might

¹³ See 16 U.S.C. § 1533(f)(1) (1994).

¹⁴ See 16 U.S.C. § 1534 (1994).

¹⁵ 16 U.S.C. § 1536(a)(2) (1994).

¹⁶ *Id.*

¹⁷ 16 U.S.C. § 1536(a)(1). The case law on this requirement suggests that this is an enabling provision rather than a requirement that agencies devote their resources completely to conservation. See, e.g., *Carson-Truckee Water Conservancy District v. Clark*, 741 F.2d 257 (9th Cir. 1984) (holding that the ESA allows, but does not require, a federal agency to take steps to encourage the recovery of a listed species).

¹⁸ See 16 U.S.C. § 1538(a)(1)(A), (E), (F) (1994); 16 U.S.C. § 1538(a)(2)(A), (C), (D) (1994).

¹⁹ See 16 U.S.C. § 1538(a)(1) (1994). The ESA only prohibits the taking of "endangered" species of fish or wildlife, but the FWS has extended this prohibition to "threatened" species as well. See *Endangered and Threatened Wildlife and Plants; Threatened Wildlife*, 50 C.F.R. § 17.31(a) (1998).

²⁰ 16 U.S.C. § 1532(19) (1994).

²¹ *Endangered and Threatened Wildlife and Plants; Introduction and General Provisions*, 50 C.F.R. § 17.3 (1998). The FWS initially promulgated this regulation in 1975, and amended it in 1981 to limit this prohibition to actions that actually kill or injure wildlife. See 40 Fed. Reg. 44,412 (1975); *Endangered and Threatened Wildlife and Plants; Final Redefinition of "Harm,"* 46 Fed. Reg. 54,748, 54,750 (1981).

have to refrain from logging, farming, or developing property into a golf course, a shopping mall, or residential housing.²²

The ESA provides some exemptions to the restrictions on private landowners. Landowners may obtain an "incidental take" permit from the FWS, which would allow them to develop their property even though doing so would harm a listed species.²³ The FWS can grant such permits to landowners that are willing to implement a habitat conservation plan ("HCP") for their property.²⁴ The HCP must show how the proposed development minimizes the adverse impact on protected species on the property, and it also must show that the remaining impact will not drive the species into extinction. Historically, these plans were expensive and rarely approved by the FWS,²⁵ but in recent years, the FWS has streamlined the approval process for HCPs.²⁶ The FWS has also proposed granting some small landowners outright exemptions from the restrictions against development of habitat.²⁷ Despite the new exemptions, the ESA, in combination with the FWS's regulations, still imposes substantial restrictions on some private landowners.

B. EFFECT OF THE ESA'S LAND-USE RESTRICTIONS

All sides of the debate on protecting endangered species are dissatisfied with the FWS's land-use restrictions. These restrictions have been attacked by everyone from the Environmental Defense Fund to Don Young, the conservative Congressman from Alaska.²⁸ Critics argue that the FWS's land-use restrictions make harboring a listed species too costly for landowners. Professor Stroup's discussion of the ESA succinctly captures the essence of these critiques.²⁹ Professor Stroup characterizes the restrictions as a "tax" on owning land that provides habitat

²² See *Northwest Forest Resource Council v. Pilchuk Audubon Society*, 97 F.3d 1161 (9th Cir. 1997) (logging impeded due to presence of an endangered bird species); MANN & PLUMMER, *supra* note 5, at 180-211 (housing construction restricted); Marla Cone & Diana Marcum, *California and the West: Desert Bighorns to Get U.S. Protection*, L.A. TIMES, Mar. 13, 1998, at A3 (construction of golf courses delayed); *Species Protection and Sense: Legislation Can End Overkill Through Progressive Reform*, L.A. TIMES, Sept. 12, 1997, at B8 (farming and the construction of a shopping mall impeded by the ESA).

²³ See 16 U.S.C. § 1539(a) (1994).

²⁴ See *id.*

²⁵ See Eric Fisher, Comment, *Habitat Conservation Planning Under the Endangered Species Act: No Surprises and the Quest for Certainty*, 67 U. COLO. L. REV. 371, 373-74 (1996).

²⁶ See J.B. Ruhl, *Who Needs Congress? An Agenda for Administrative Reform Under the Endangered Species Act*, 6 N.Y.U. ENVTL. L.J. 367, 396-97 (1998).

²⁷ See *id.* at 394-96.

²⁸ See WILCOVE ET AL., *supra* note 5; Quane Kenyon, *Endangered Species Bill Comes Under Criticism: Alaska Congressman Says Amendment Doesn't Protect Property Rights*, IDAHO STATESMAN, Jan. 22, 1998, at 4B.

²⁹ Stroup, *supra* note 5, at 59.

for endangered species. He contends that these restrictions have the same impact on the availability of habitat for listed species that an income tax has on tax revenue. A small income tax generates revenue and increases in the tax rate can increase revenue. As the tax rate rises, however, it makes undertaking the taxed activity less attractive. Consequently, large increases in the tax rate eventually reduce tax revenue. Professor Stroup argues that if the costs of the FWS's land-use restrictions are sufficiently high, they will actually *reduce* the amount of habitat available for listed species.

The FWS's land-use restrictions might have an even greater impact on species that are in decline, but that are not yet listed. Before declaring a species to be endangered or threatened, the FWS must publish notices of its intent to list a species in the Federal Register and in the newspapers of affected communities.³⁰ These notices warn landowners of the prospect of future restrictions on the use of their property. Because it is perfectly legal to modify the habitat of unlisted species, this notification can induce landowners to remove candidate species from their property or to adversely modify their habitat before listing is final.³¹ Local landowners might also organize to oppose the listing of a species, which can result in expensive litigation over the listing decisions. Because the FWS has a limited budget for listing species and a pervasive backlog of species that need to be listed,³² the prospect of such litigation might affect the FWS's decisionmaking, possibly imperiling species that need the ESA's protection.

In addition to encouraging landowners to undertake legal activities that harm species, the high cost of the FWS's land-use restrictions might also encourage them to take illegal action. The penalties for knowing violations of the ESA can be severe and include the possibility of a jail sentence.³³ The prospects for adequate enforcement of the ESA's prohibition against adverse modification of habitat, however, are slim. Listed species are scattered throughout all fifty states, and there are only limited personnel available to enforce the ESA. The potential profits from developing species habitat might induce some landowners to "shoot, shovel, and shut up,"³⁴ even though such action is illegal.

The critics thus make a good case that the FWS's land-use restrictions create unintended incentives to harm species. Indeed, it is almost

³⁰ See 16 U.S.C. § 1533(b)(5) (1994).

³¹ The FWS can avoid this by listing the species on an emergency basis, which then gives it immediate protection. See 16 U.S.C. § 1533(b)(7) (1994).

³² See Oliver A. Houck, *The Endangered Species Act and Its Implementation by the U.S. Departments of Interior and Commerce*, 64 U. COLO. L. REV. 277, 292-96 (1993).

³³ See 16 U.S.C. § 1540(b)(1) (1994) (a violation may be punished by imprisonment of up to one year).

³⁴ Lehman, *supra* note 6.

economic dogma that land-use restrictions always create these sort of unwanted incentives.³⁵ Rent control, for example, is supposed to increase the availability of low-cost housing in urban areas, but because it reduces the value of rental properties, it also reduces their availability.³⁶ In the case of endangered species protection, however, the critics might be overstating their argument. Unlike rent-control regulations, the ESA imposes costs on the activities that it is seeking to deter. The FWS's regulations simultaneously make destroying existing habitat and creating new habitat costly for landowners. Thus, if the benefits to a species of preserving existing habitat outweigh the costs of impeding the creation of new habitat, then land-use restrictions will provide a net benefit for a protected species.

Indeed, situations in which the FWS's land-use restrictions do more harm than good to a listed species are probably the exception, not the norm. The regulations diminish the available habitat for a listed species only when several factors are present. First, existing habitat must be disappearing despite the FWS's land-use restrictions. This result occurs either because the habitat is in a natural state of transition or because the penalties for violating the ESA are inadequate to deter people from illegally destroying species habitat. Second, those who own land that might attract a listed species must have a clear technique available to maintain their property in an inhospitable state for the species. Third, this technique must be less costly than the land-use restrictions themselves. Fourth, these circumstances must be widely understood by landowners. Situations in which these four factors coincide sometimes arise and produce anecdotal support for the theory that land-use restrictions are harmful to listed species,³⁷ but it is not clear how common they are.

In the end, even though the FWS's land-use restrictions might create unwanted incentives, with respect to the preservation of most species, the restrictions are probably beneficial. Listed species might be better off if landowners were compensated for the economic cost that the ESA imposes, but in the absence of compensation, it is not clear that species are in a worse state because of the FWS's land-use restrictions.

The effect of the land-use restrictions on states and municipalities is uncertain. The ESA's prohibitions against jeopardizing the continued existence of or destroying the critical habitat of any listed species do not apply to state and local governments, but its prohibition against "taking"

³⁵ See Stroup, *supra* note 5, at 56.

³⁶ See Edgar O. Olsen, *An Econometric Analysis of Rent Control*, 80 J. POL. ECON. 1081 (1972).

³⁷ See MANN & PLUMMER, *supra* note 5, at 180-211.

does apply.³⁸ Given the vast differences in amount and type of land that states hold, states probably take a variety of different approaches to the presence of endangered species on their lands. States that want to encourage development might well be subject to the same incentives to destroy habitat that private parties face, whereas states with conservationist preferences might voluntarily use their land to preserve species.

II. ENDANGERED AND THREATENED PLANTS

A. FEDERAL PROTECTION OF ENDANGERED AND THREATENED PLANTS

The concern with perverse incentives, however, is irrelevant to plants; the ESA's prohibition against "taking" listed species applies only to animals. Consequently, the FWS's land-use restrictions do not affect owners of land occupied by listed plants. Nothing in the ESA, or in the accompanying FWS regulations, prevents landowners from killing any plant on their property or from adversely modifying its habitat.

Nevertheless, the ESA includes some protection for listed plants. The restrictions on federal agencies apply equally to plants and animals,³⁹ and the ESA makes it illegal to "remove and reduce to possession" or "maliciously damage or destroy"⁴⁰ any listed plant on federal land. The ESA also bans all commerce in listed plants,⁴¹ and it makes it illegal to "remove, cut, dig up, or damage or destroy" a listed plant "in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law."⁴² Absent any state restriction, however, private landowners are free to destroy the habitat of listed plants on their property.⁴³

Although the ESA does not directly affect private landowners' use of their property, it can indirectly restrict their activities. Under certain circumstances, private landowners need permission from a federal

³⁸ The restriction against takings applies to any "person." 16 U.S.C. § 1538(a)(1) (1994). The ESA's definition of "person" includes "any officer, employee, agent, department, or instrumentality of . . . any State, municipality, or political subdivision of a State." 16 U.S.C. § 1532(13) (1994).

³⁹ See 16 U.S.C. § 1536(a)(2) (1994).

⁴⁰ 16 U.S.C. § 1538(a)(2)(A) (1994).

⁴¹ See 16 U.S.C. § 1538(a)(2)(C), (D) (1994).

⁴² 16 U.S.C. § 1538(a)(2)(A) (1994). Bootstrapping state violations into federal ones may seem trivial, except that the penalties under the ESA often vastly exceed those provided by state law. For example, the fine for violating New York's endangered plant statute is a maximum fine of only \$25. See N.Y. Envtl. Conserv. Law § 9-1503(3) (Consol. 1982). Because a knowing violation of this state statute would also violate the ESA, the penalties may actually be much greater.

⁴³ The distinction between directly killing a species and dramatically reducing its prospects for survival by destroying its habitat probably matters more for animals, which can temporarily abandon their nests or burrows, than it does for plants. Developing a plant's habitat probably entails directly "taking" the plant.

agency to undertake development of their property, which an agency might be unable to grant if the development would harm listed plants. This situation occurs in at least four instances. First, those who own land designated as a "wetland" under section 404 of the Federal Water Pollution Control Act must obtain a permit from the United States Army Corps of Engineers ("Army Corps") before dredging and filling the wetland.⁴⁴ The ESA forbids the Army Corps from granting such a permit if doing so might jeopardize the continued existence of a listed species or if it would adversely alter land designated by the FWS as the critical habitat of a listed species.⁴⁵ Second, the Federal Insecticide, Fungicide, and Rodenticide Act forbids the use of any pesticide in the United States unless it is registered by the Environmental Protection Agency ("EPA").⁴⁶ Because of the ESA's prohibitions, the EPA may not register a pesticide for any use that would jeopardize the continued existence of any listed species or adversely alter the critical habitat of any listed species. This requirement thereby restricts private individuals' use of pesticides.⁴⁷ Third, the Federal Energy Regulatory Commission ("FERC") may not grant a license to generate and to sell electricity from a dam if its construction and operation would jeopardize a listed plant or harm the critical habitat of a listed plant.⁴⁸ Fourth, any construction project that benefits from federally-subsidized loans or insurance programs might be affected by the presence of a listed plant.⁴⁹

These indirect restrictions encourage the destruction of listed plants. Because the ESA does not prohibit private landowners from taking listed plants, landowners may eliminate listed plants so as to free themselves from restrictions. Consider the wetlands program as an example. Landowners concerned that the presence of a listed plant on their property will cause the Army Corps to deny an application for a dredge-and-fill permit for a wetland are free to eradicate all listed plants from their property *before applying for the permit*. Unless the FWS has designated the wetland as the critical habitat of a listed species, the destruction of the plants also removes the constraints on the Army Corps, allowing them to grant the construction permit. Pesticide registration, FERC licensing, and federally-subsidized construction projects present similar issues. The com-

⁴⁴ See 33 U.S.C. § 1344 (1994).

⁴⁵ See Bradley C. Karkkainen, *Biodiversity and Land*, 83 CORNELL L. REV. 1, 61-62 (1997).

⁴⁶ See 7 U.S.C. § 136a(a) (1994).

⁴⁷ Information on the scope and extent of EPA's pesticide restrictions that are designed to protect listed species can be found on the Internet. See United States Environmental Protection Agency, *Endangered Species Protection Program* (visited May 28, 1998) <<http://www.epa.gov/oppfead1/endanger/>>.

⁴⁸ See 16 U.S.C. §§ 791-835r (1994).

⁴⁹ See Katharine Rosemary, *The Effect of the Endangered Species Act on Housing Construction*, 33 HASTINGS L.J. 551 (1982).

bination of unconstrained landowners and constrained federal agencies produces incentives for landowners to eliminate any listed plants before requesting agency permission for their activities.⁵⁰

The FWS could eliminate this incentive to destroy the habitat by designating property as a species' critical habitat. Federal agencies may not aid in the destruction of land designated as critical habitat, regardless of the presence or absence of a listed plant on that habitat. The FWS, however, has designated critical habitat for only twenty-four of the 669 listed plants.⁵¹ This leaves most plants in wetlands, on farms, and in riparian settings at severe risk of destruction by private landowners. Endangered plants that grow on private property might be better off if they are not listed.

Other than these unusual cases, the ESA creates few incentives either to destroy or to preserve listed plants on private property. Listing provides some protection for those plants that inhabit federal land. It also adds federal protection to plants protected by state law, including state trespass laws. For the most part, the ESA relegates the fate of listed plants on private land to the benevolence of the landowner.

B. STATE LAWS PROTECTING PLANTS

Most states and territories have adopted their own endangered species statutes, some of which protect endangered plants. Even though the ESA does not directly prohibit private landowners from destroying listed plants, several jurisdictions have statutes that do. Furthermore, because a knowing violation of any state statute protecting listed plants also violates the ESA,⁵² in those jurisdictions that restrict private landowners, the ESA also restricts private landowners. The substantive provisions of the ESA and the FWS regulations, therefore, are only a part of the law protecting endangered and threatened plants.

Most states and territories do not, however, protect endangered plants. Nineteen states, Puerto Rico, and the District of Columbia have

⁵⁰ Although the ESA creates this incentive, it is unclear how often private parties eliminate listed plants to avoid federal restrictions. Mann and Plummer reported one such incident, in which a construction company bulldozed a population of the endangered San Diego mesa mint to facilitate a loan from the Veterans Administration. *See* MANN & PLUMMER, *supra* note 5, at 187 (reporting that this incident was part of an effort by the landowner to avoid the restriction against "taking" before the mesa mint became officially listed).

⁵¹ This number was determined by searching the two databases of listed plants for plants that have critical habitat designations. *See* United States Fish & Wildlife Service, Division of Endangered Species, *U.S. Listed Flowering Plant Species Index By Lead Region and Status, as of April 30, 1998* (visited May 28, 1998) <<http://www.fws.gov/r9endspp/pl1data.html>>; United States Fish & Wildlife Service, Division of Endangered Species, *U.S. Listed Non-Flowering Plant Species Index By Lead Region and Status, as of April 30, 1998* (visited May 28, 1998) <<http://www.fws.gov/r9endspp/pl2data.html>>.

⁵² *See* 16 U.S.C. § 1538(a)(2)(B) (1994).

no laws pertaining to endangered or threatened plants.⁵³ Another nine states have statutes that authorize the creation of a state list of endangered plants, but do not provide any substantive protection to plants on private land in addition to that provided by the ESA.⁵⁴ Some of these jurisdictions have adopted restrictions that duplicate those contained in the ESA. For example, Texas forbids taking protected plants from public land for commercial purposes,⁵⁵ but because the ESA also forbids the commercial sale of endangered plants,⁵⁶ this restriction is redundant. In summary, the laws in twenty-eight states, Puerto Rico, and the District of Columbia do not protect plants on private land more than the ESA does.⁵⁷

Most of the remaining jurisdictions add only minimal protection for listed plants. The laws in thirteen states forbid anyone from taking a protected plant from private property without the permission of the landowner.⁵⁸ For the most part, these statutes duplicate the ESA's prohibition against harming a listed plant while violating state criminal trespass laws.⁵⁹ These "permission" statutes might make it somewhat easier for a private landowner that is inclined to preserve species to protect them, but in these states landowners may still legally destroy protected plants.

⁵³ The nineteen states with no relevant laws are Alabama, Alaska, Arkansas, Colorado, Delaware, Idaho, Indiana, Kansas, Louisiana, Maine, Mississippi, Montana, North Dakota, Oklahoma, South Carolina, Utah, Washington, West Virginia, and Wyoming.

⁵⁴ The nine states are Georgia, Kentucky, Maryland, Nebraska, Nevada, New Jersey, New Mexico, Rhode Island, and Texas. *See* GA. CODE ANN. §§ 12-6-170 to 12-6-176 (1996); KY. REV. STAT. ANN. §§ 146.600-.619 (Banks-Baldwin 1996); MD. CODE ANN., NAT. RES. § 10-2A (1990 & Supp. 1997); NEB. REV. STAT. §§ 430-438 (1993); NEV. REV. STAT. §§ 527.260-.300 (1986); N.J. REV. STAT. §§ 13:1B-15.151 to 13:1B-158 (1991); N.M. STAT. ANN. § 75-6-1 (Michie 1994); R.I. GEN. LAWS § 20-37 (1989); TEX. REV. CIV. CODE ANN. §§ 88.001-.012 (West 1991).

⁵⁵ *See* TEX. REV. CIV. STAT. ANN. § 88.008(a) (West 1991).

⁵⁶ *See* 16 U.S.C. § 1538(a)(2)(C) (1994).

⁵⁷ The law in two of these states is somewhat ambiguous, but probably does not add any substantive protection for endangered plants. Nevada requires landowners to obtain a permit before removing any protected plant species from their property, but does not specify the circumstances that justify granting or denying a permit. *See* NEV. REV. STAT. § 527.270 (1986). New Mexico's endangered plant law authorizes a state agency to adopt regulations restricting the taking of protected plants, but the agency has not done so. *See* N.M. STAT. ANN. § 75-6-1(D) (Michie 1994).

⁵⁸ The thirteen states are Connecticut, Florida, Illinois, Missouri, New Hampshire, New York, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Virginia, and Wisconsin. *See* CONN. GEN. STAT. § 26-311 (Supp. 1998); FLA. STAT. ch. 581.185(3) (Supp. 1998); 520 ILL. COMP. STAT. 10/3 (1993); MO. REV. STAT. § 252.240(5) (West 1990); N.H. REV. STAT. ANN. § 217-A:9 (Supp. 1997); N.Y. ENVTL. CONSERV. LAW § 9-1503(5) (Consol. 1982); N.C. GEN. STAT. § 16-202.19(a)(1) (1995); OHIO REV. CODE ANN. § 1518.02 (Anderson 1997); OR. REV. STAT. § 564.120(2) (1988); 32 PA. CONS. STAT. § 5307(I) (1997); TENN. CODE ANN. § 70-8-309(a) (1995); VA. CODE ANN. § 3.1-1023 (Michie 1994); WIS. STAT. § 29.415(4)(c) (1989 & Supp. 1997).

⁵⁹ *See* 16 U.S.C. § 1538(a)(2)(B) (1994).

California and Arizona have adopted somewhat unique endangered plant protection statutes.⁶⁰ Their statutes resemble the "permission" statutes described above, but they also forbid landowners from destroying a protected plant without first informing a state conservation agency of their intent to do so, and then refraining from destroying the plant for a short period of time. During this waiting period, the state conservation agency may enter the property and transplant the plant.⁶¹ It is unclear how successful these transplant programs are. If the primary threat to the species is the widespread loss of habitat, then providing the opportunity to transplant plants might be a meaningless exercise. Nevertheless, these "notice" statutes represent a compromise between the interests of the landowner and the preservation of the species. Construction delays caused by these statutes might impose some costs on landowners, but far less than the costs of a prohibition on development. At the same time, if the transplant is successful, the benefit to the species could be tremendous.

Finally, seven states, Guam, and the Virgin Islands prohibit private landowners from killing or adversely modifying the habitat of any protected plant.⁶² Two of these jurisdictions have exceptions; Massachusetts law allows a private landowner to construct a single family dwelling even if doing so would result in the taking of a protected plant,⁶³ and Minnesota law exempts some farmers from this restriction.⁶⁴ Otherwise, the presence of listed plants imposes the same restrictions on landowners in these jurisdictions that the presence of listed animals does. It is notable that one of these jurisdictions, Hawaii, is also probably the most significant battleground in endangered plant protection. Hawaii contains the exclusive habitat of 263 listed plants, which is 39.3% of the total number of listed plants.⁶⁵ Overall, 283 plants (42.3% of the total) have

⁶⁰ See ARIZ. REV. STAT. ANN. §§ 3-901 to 3-934 (West 1995); CAL. FISH & GAME CODE §§ 1900-1913 (West 1984).

⁶¹ In Arizona, the delay depends upon the size of the property being cleared of protected plants: 20 days for less than one acre, 30 days for between one and 40 acres, and 60 days for more than 40 acres. See ARIZ. REV. STAT. ANN. § 3-903(A)(3) (West 1995). In California, the landowner must provide 10 days notice. See CAL. FISH & GAME CODE § 1913(c) (West 1984). California also only applies this restriction to landowners that are given notice of the presence of a protected plant on their property by the state department of fish and game. See *id.*

⁶² The seven states are Hawaii, Iowa, Massachusetts, Minnesota, Michigan, South Dakota, and Vermont. See HAW. REV. STAT. § 195D-4(e) (1997); IOWA CODE § 481B.5 (Supp. 1998); MASS. GEN. LAWS ch. 131A, § 2 (Supp. 1998); MICH. COMP. LAWS § 36505 (Supp. 1998); MINN. STAT. § 84.0895 (Supp. 1998); S.D. CODIFIED LAWS § 34A-8 (Michie 1992); VT. STAT. ANN. tit. 10, § 5403 (1997); see also 5 GUAM CODE ANN. § 63206(b) (1995); V.I. CODE ANN. tit. 12, § 105 (1995).

⁶³ See MASS. GEN. LAWS ch. 131A, § 3 (Supp. 1998).

⁶⁴ See MINN. STAT. § 84.0895 (Supp. 1995).

⁶⁵ The total number of listed plant species was found on the Internet. See United States Fish & Wildlife Service, Division of Endangered Species, *Endangered Species Home Page* (visited May 28, 1998) <<http://www.fws.gov/r9endspp/boxscore.html>>. The number of spe-

at least some habitat in states and territories that prohibit private landowners from taking listed plants.⁶⁶

Table 1 summarizes state and territorial law regarding endangered and threatened plants on private land. Each jurisdiction can be classified as having adopted one of four types of statutes: statutes that prohibit landowners from taking protected species on private land ("restriction" statutes); statutes that require landowners to provide notice to a state agency before they take a protected species on private land ("notice" statutes); statutes that prohibit taking protected species on private land without the permission of the landowner ("permission" statutes); and statutes that do not add any substantive protection in addition to that provided by the ESA (including jurisdictions that have not adopted statutes regarding endangered or threatened plants).

In most jurisdictions, the law is silent as to restrictions on state agencies and on the status of protected species on state or territorial land. Of the nine jurisdictions with restriction statutes, four also explicitly prohibit state and local entities from taking protected species.⁶⁷ In the other five jurisdictions, the statutes do not refer to state and local entities, but they also probably restrict state and territorial entities in the same way that they restrict private parties. Five other jurisdictions prohibit state and local entities from using property in ways that harm protected plants; Connecticut and Wisconsin have adopted restrictions similar to those that the ESA places on federal agencies,⁶⁸ and Arizona, Florida, and Oregon require state agencies to consult with a state wildlife commission on projects that harm protected plants and to consider alternatives to such projects.⁶⁹

The jurisdictions that require permission from a landowner before a protected plant may be removed also presumably require such permission when the landowner is the state, although only Florida specifically requires such permission.⁷⁰ In addition, three of the thirteen states with permission statutes, Connecticut, New Hampshire, and Ohio, forbid

cies in Hawaii was also found on the Internet. See United States Fish & Wildlife Service, Division of Endangered Species, *Region 1 Listed Species Under U.S. Fish and Wildlife Service Jurisdiction By State, as of 04/30/98* (visited May 28, 1998) <<http://www.fws.gov/r9endspp/statl-r1.html>>.

⁶⁶ The number of species found in the nine jurisdictions with restriction statutes was found on the Internet. See United States Fish & Wildlife Service, Division of Endangered Species, *State Lists of Endangered Species Under U.S. Fish and Wildlife Service Jurisdiction (By Service Region)* (visited May 28, 1998) <<http://www.fws.gov/r9endspp/stat-reg.html>>.

⁶⁷ The four states are Hawaii, Iowa, Massachusetts, and Guam. See HAW. REV. STAT. § 195D-2 (1997); IOWA CODE § 481B.1(6) (Supp. 1998); MASS. GEN. LAWS ch. 131A, § 1 (Supp. 1998); 5 GUAM CODE ANN. § 63203(I) (1995).

⁶⁸ See CONN. GEN. STAT. § 26-310 (1990); WIS. STAT. § 29.415(6r) (Supp. 1997).

⁶⁹ See ARIZ. REV. STAT. ANN. § 3-905 (West 1995); FLA. STAT. ch. 581.185 (Supp. 1998); OR. REV. STAT. § 564.115 (1988).

⁷⁰ See FLA. STAT. ch. 581.185(3) (Supp. 1998).

TABLE 1: STATE AND TERRITORIAL LAW REGARDING LISTED PLANTS

Landowners prohibited from taking protected species ("restriction")	Landowners must provide notice before taking protected species ("notice")	Taking of protected species prohibited without permission of landowner ("permission")	No substantive restrictions on private parties	
			Statute that adds no protection	No Statute
Hawaii, Iowa, Massachusetts, Michigan, Minnesota, South Dakota, Vermont, Guam, the Virgin Islands.	Arizona, California.	Connecticut, Florida, Illinois, Missouri, New Hampshire, New York, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Virginia, Wisconsin.	Georgia, Kentucky, Maryland, Nebraska, Nevada, New Jersey, New Mexico, Rhode Island, Texas.	Alabama, Alaska, Arkansas, Colorado, Delaware, Idaho, Indiana, Kansas, Louisiana, Maine, Mississippi, Montana, North Dakota, Oklahoma, South Carolina, Utah, Washington, West Virginia, Wyoming, District of Columbia, Puerto Rico.

harming protected plants on any state land;⁷¹ and one jurisdiction, Pennsylvania, forbids harming protected plants on state parks and preserves.⁷² Furthermore, even though it does not have a general permission statute, Georgia also forbids the taking of protected plants from state land without permission from the state.⁷³ Among the remaining jurisdictions, only one has any law dealing with endangered plants on state and territorial land; Texas forbids taking any protected species from state land for commercial purposes.⁷⁴ The remaining jurisdictions, however, presumably treat plants on state and territorial land as the property of the state or territory. Removing such plants might violate state trespass law, even without a statute specifically protecting endangered or threatened plants.

Some state land-use restrictions, other than statutes dealing directly with endangered plants, can indirectly restrict private landowners. As noted above, two states, Connecticut and Wisconsin, have adopted statutes restricting state agencies in the same way that the ESA restricts federal agencies, forcing them to deny permits to private parties for any

⁷¹ See CONN. GEN. STAT. § 26-311 (1990); N.H. REV. STAT. ANN. § 217-A:9 (Supp. 1997); OHIO REV. CODE ANN. § 1518.02 (Anderson 1997).

⁷² See 32 PA. CONS. STAT. § 5311(a) (1997).

⁷³ See GA. CODE ANN. § 12-6-170 to 12-6-173 (1996).

⁷⁴ See TEX. REV. CIV. STAT. ANN. art. 88.008(a) (West 1991).

activity that might endanger protected species.⁷⁵ Other states also require permits for certain activities, which are more difficult to obtain if the underlying activity harms protected plants. For example, California requires that private parties submit a timber harvest plan before it will allow any logging that would disturb protected plants.⁷⁶ Similarly, New Mexico makes it more difficult to obtain a mining permit if protected plants inhabit the mining site.⁷⁷ In New York, any agency activity that "may have a significant effect on the environment" requires an environmental impact statement that must describe (among other things) any adverse consequences to any protected plant species.⁷⁸ Finally, any municipality can alter its zoning ordinances to protect endangered plant species on private property from development. A private party could avoid these impediments to obtaining permission for their activities by completely eradicating the protected plant species from their property before applying for permission. These indirect restrictions create the same incentives for private landowners to eliminate protected species that indirect federal restrictions do.⁷⁹

The thirty-three jurisdictions that have adopted laws governing endangered and threatened plants all have their own lists of protected plant species, aside from the federally listed species.⁸⁰ Most jurisdictions (twenty-six) automatically include any species designated as endangered or threatened by the FWS on their own list of protected species. The

⁷⁵ See CONN. GEN. STAT. § 26-310 (1990); WIS. STAT. § 29.415(6r) (Supp. 1997).

⁷⁶ See CAL. PUB. RES. CODE § 4581-4592 (West 1984) (general requirements that timber harvest plan be submitted); CAL. CODE REGS. tit. 14, § 1038(b)(7) (1998) (no exemptions from preparing a timber harvest plan if endangered plants will be disturbed by logging).

⁷⁷ See 7 N.M. Reg. 1174 (1998).

⁷⁸ N.Y. ENVTL. CONSERV. LAW § 8-0109 (Consol. 1982) (requiring an environmental impact statement); N.Y. COMP. CODES R. & REGS. tit. 6, § 617.11(a)(2) (1998). See, e.g., *West Branch Conservation Ass'n, Inc. v. Planning Bd.*, 177 A.D. 2d 917, 576 N.Y.S. 2d 675 (1991) (presence of endangered plant on site planned for housing development required the drafting of a full environmental impact statement).

⁷⁹ See *infra* notes 44-50 and accompanying text.

⁸⁰ See ARIZ. REV. STAT. ANN. § 3-903(B)(1) (West 1995); CONN. GEN. STAT. § 26-304(7), (8) (1990); FLA. STAT. ch. 581.185(2)(b) (Supp. 1998); HAW. REV. STAT. § 195D-4(a) (1997); 520 ILL. COMP. STAT. 10/2 (Supp. 1998); KY. REV. STAT. ANN. § 146.605 (Banks-Baldwin 1996); MD. CODE ANN., NAT. RES. § 10-2A-01(d) (Supp. 1997); MASS. GEN. LAWS ch. 131A, § 1 (Supp. 1998); MO. REV. STAT. § 252.240 (West 1990); NEB. REV. STAT. § 431(4) (1993); N.H. REV. STAT. ANN. § 217-A:3(III) (1997); N.J. REV. STAT. § 13:1B-15.153 (1998); N.M. STAT. ANN. § 75-6-1(A) (Michie 1994); N.C. GEN. STAT. § 16-202.12(4) (1995); OHIO REV. CODE ANN. § 1518.01 (Anderson 1997); OR. REV. STAT. § 564.100(3)(b) (1988); R.I. GEN. LAWS § 20-37-2(3) (1989); TENN. CODE ANN. § 70-8-303(a)(5) (1995); TEX. REV. CIV. CODE ANN. § 88.002 (West 1991); VT. STAT. ANN. tit. 10, § 5401(6), (7) (1997); WIS. STAT. § 29.415(3) (1989); 5 GUAM CODE ANN. § 63203(e) (1995); V.I. CODE ANN. tit. 12, § 102(e) (1995). Three states, Iowa, Michigan, and South Dakota, maintain separate lists of protected species, but extend the same protections to species on the federal list as they do to species on their own list. See IOWA CODE § 481B.5 (Supp. 1998); MICH. COMP. LAWS § 36505(1)(c) (Supp. 1998); S.D. CODIFIED LAWS § 34A-8-9(4) (Michie 1992).

other seven jurisdictions,⁸¹ however, do not automatically include the federally listed plants on their own lists. Some federally listed plants in these jurisdictions might therefore not be protected by the states' endangered plant statutes.

III. THE PRESENT STUDY

The present study was designed to determine the effect that statutes restricting private landowners have on protected species. To accomplish this, the condition of listed plant species was compared to that of animal species. Because the presence of a listed plant species on private land does not usually restrict a landowner's activities in the way that the presence of a listed animal species does, this comparison provided some indication of the effects of laws restricting landowners on protected species. The condition of plant species on habitat owned by different types of parties was also analyzed to determine whether private ownership of habitat generally contributes to the decline of listed plant species. Finally, the effects of the four types of state and territorial law on listed plant species, both on and off of privately owned land, were assessed.

A. DATA AND METHODS

The 1988 amendments to the ESA require the FWS to generate bi-annual reports on the endangered species program.⁸² As of this writing, the FWS has produced reports for 1990, 1992, and 1994.⁸³ Data from the 1994 FWS Report served as the basis for the present analysis. This Report included data on the 891 species (410 animals and 481 plants) listed at the time that the Report was issued. It identified each species' population as improving, stable, declining, extinct, or unknown. This designation (hereinafter referred to as "species status" or "status") provided the primary dependent variable for the present analysis.

As a measure of how well listed species are faring, species status has its faults. This parameter has been criticized by the National Re-

⁸¹ The other seven jurisdictions are California, Georgia, Minnesota, Nevada, New York, Pennsylvania, and Virginia. *See* CAL. FISH & GAME CODE § 1901 (West 1984); GA. CODE ANN. § 12-6-172(a) (1996); MINN. STAT. § 84.0895 (1995); N.Y. ENVTL. CONSERV. LAW § 9-1502 (Consol. 1982); 32 PA. CONS. STAT. § 5307 (1997); VA. CODE ANN. § 3.1-1021 (Michie 1994).

⁸² *See* Endangered Species Act, Pub. L. No. 100-478, §§ 1002-1004, 102 Stat. 2306, 2307 (1988); 16 U.S.C. § 1533(f)(3) (1994).

⁸³ *See* U.S. FISH AND WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR, REPORT TO CONGRESS, ENDANGERED AND THREATENED SPECIES RECOVERY PROGRAM (1990); U.S. FISH AND WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR, REPORT TO CONGRESS, ENDANGERED AND THREATENED SPECIES RECOVERY PROGRAM (1992); U.S. FISH AND WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR, REPORT TO CONGRESS, RECOVERY PROGRAM, ENDANGERED AND THREATENED SPECIES (1994) (hereinafter 1994 FWS REPORT).

search Council as too subjective.⁸⁴ The FWS has not clearly described its criteria for determining species status.⁸⁵ Furthermore, species status does not always provide an accurate indication of a species' true viability. The FWS has designated some species that are on the brink of extinction as stable. The entire population of Presidio Manzanita trees, for example, consists of a single specimen, but nevertheless the FWS designated the species as stable.⁸⁶ It is true that the remaining tree is currently healthy, but designating the Presidio Manzanita as stable seems inappropriate under the circumstances. Despite these problems, species status should correlate with the actual condition of species. Noise and error in the dependent measure might obfuscate small effects, but strong, accurate trends should still emerge, if they exist.

Ownership of species habitat was identified from the FWS's announcement of its final determination that a species is endangered or threatened. The FWS publishes these announcements in the Federal Register along with findings necessary to support its determination. For each plant species, these findings include a detailed description of the habitat, which includes a description of how the habitat is being used. In the case of habitat held by the federal government, the FWS also identifies the federal agency that manages it. For this analysis, habitat owners were classified into one of fourteen different categories. The Federal Register announcements identify six different federal owners: the Bureau of Land Management ("BLM"), the United States Forest Service ("USFS"), the National Park Service ("NPS"),⁸⁷ the National Wildlife Refuges ("NWR"), the Department of Defense ("DoD"), and Native American reservations. State land was divided by use into three categories: wildlife refuges and preserves, state and local parks, and all other state land (which commonly included roadsides and highway medians). Private land was divided by use into five categories: land subject to residential or commercial development (including presently undeveloped land that is likely to be developed), agricultural land other than range or pasture land, grazing land (range or pasture land), undeveloped land (land not suitable for any of the previous uses), and land identified by the FWS as held privately for the protection of listed species. Table 2 summarizes the fourteen types of owners. The percentage of each plant species' habitat held by each of these fourteen types of owner was determined from the Federal Register announcements. Unfortunately, re-

⁸⁴ See NATIONAL RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT 197-98 (1995).

⁸⁵ See *id.*

⁸⁶ See 1994 FWS REPORT, *supra* note 83, at 57; Determination that *Arctostaphylos hookeri* ssp. *ravenii* is an Endangered Species, 44 Fed. Reg. 61,910 (1990).

⁸⁷ This analysis treated wilderness areas and national monuments as NPS land because of the similar status of these areas.

liable data on the ownership of the habitat of animal species was not available for a sufficient percentage of the animal species to provide a meaningful analysis.

TABLE 2: OWNER CATEGORIES USED IN THE ANALYSIS

FEDERAL LAND
1. Bureau of Land Management ("BLM")
2. United States Forest Service ("USFS")
3. National Park (including wilderness areas and national monuments) ("NPS")
4. National Wildlife Refuges ("NWR")
5. Department of Defense ("DoD")
6. Native American Reservation
STATE (OR TERRITORIAL) LAND
7. State Wildlife Refuge or Preserve
8. State (or Local) Park
9. Other State Land
PRIVATE LAND
10. Residential/Commercial (including undeveloped land likely to be developed)
11. Agricultural (other than range or pasture land)
12. Range or Pasture Land
13. Undeveloped Land
14. Privately Protected Land

A few other variables were determined from the information in the Federal Register announcements. For each species, three composite landowner variables were created, corresponding to the total percentage of habitat held by federal, state, or private landowners. Also, the predominant landowner of the three was identified (i.e., the landowner that held the greatest percentage of each species' habitat). Furthermore, species described by the FWS as relying on wetlands were recorded as such.

The Federal Register announcements also identify the states or territories containing the species' habitat. This information was used to designate the type of state or territorial law that applied to each species. Species with habitat in multiple jurisdictions were designated as protected by the law of the jurisdiction(s) that contained a majority of the species' habitat. For example, a species with habitat equally divided between three jurisdictions, two with restriction statutes and one without any laws regarding endangered plants, would have been designated as being protected from taking by private landowners. Species in the seven jurisdictions that maintain lists of protected species separate from the federal list were designated as being unprotected unless they were also included on the state list.⁸⁸ As a result, two species in Virginia and sev-

⁸⁸ Three species were federally listed before the jurisdictions that include a majority of their habitat adopted their plant protection statutes. In New Hampshire, Robin's cinquefoil was listed in 1980, but not protected by New Hampshire law until 1987. In Oregon, MacFarlane's four-o'clock was listed in 1979 and Malheur wire-lettuce was listed in 1982, but neither

enteen species in California that were federally-listed, but not protected by these states, were designated as unprotected, even though the majority of their habitat lies in jurisdictions that provide more protection for listed plants than the ESA.⁸⁹

B. RESULTS

1. *Plants Versus Animals*

Table 3 shows the status of plants, overall. No listed plant species was known to have gone extinct, but 29.7% were declining and 39.8% had an unknown status. Only 23.0% were known to be stable and only 7.5% were known to be improving. In other words, fewer than one-third of the listed plant species are known to have a status suggesting that they would survive.

TABLE 3: STATUS OF PLANT SPECIES

Status	All Plant Species		Plant Species With a Known Status	
	Number	Percentage	Number	Percentage
Improving	36	7.5	36	12.4
Stable	111	23.0	111	38.3
Declining	143	29.7	143	49.3
Extinct	0	0.0	0	0.0
Unknown	192	39.8	—	—
Total	482	100.0	290	100.0

Although the percentage of species known to be stable or improving was low, the situation for plants was probably not as bleak as this finding suggests. Excluding species with an unknown status in the present analysis revealed that roughly half of the listed plant species with a known

was protected by Oregon law until 1987. Because all three species had been protected for a substantial period of time (seven years) at the time of the 1994 FWS REPORT, they were treated as if they had been protected throughout their history. A few other species had some presence in jurisdictions that had no endangered plant statutes at the time that they were listed but later passed such statutes: St. Thomas Prickley and Ash Vahl's boxwood (both listed in 1985, and protected by the Virgin Islands since 1990); and sandplain gerardia and small-whorled pogonia (listed in 1988 and 1982, respectively, and protected by Massachusetts since 1990). However, none of these four plants had a majority of their habitat in these jurisdictions.

⁸⁹ The two Virginia species were the Virginia round-leaf birch and the sensitive joint-vetch. The seventeen California species were the Truckee barberry, the San Bernardino Mountains bladderpod, the Cushenbury buckwheat, the Bakersfield cactus, the Parish's daisy, the San Benito evening-primrose, the San Clemente Island larkspur, the Kern mallow, the Cushenbury milk-vetch, the Cushenbury oxytheca, the McDonald's rock-cress, the Ben Lomond spineflower, the Monterey spineflower, the Robust spineflower, the Slender-horned spineflower, the Hoover's woolly-star, and the San Joaquin woolly-threads.

status were stable or improving, as shown in Table 3. Furthermore, previous analysis of these data indicated that those species identified as unknown were as likely to be eventually found to be stable or improving as those species with a known status.⁹⁰ This earlier analysis also indicated that recently listed species tended to be declining.⁹¹ The longer that a species was protected, the more likely it was to be stable or improving.⁹² In the present analysis, the correlation between the number of years a plant species had been protected and whether it was stable or improving, as opposed to declining, was .20.⁹³ This means that for each additional year that a plant had been protected, it was two percent more likely to be stable or improving, as opposed to declining.⁹⁴

The condition of plant species was similar to that of animal species. Among the 329 listed animal species with a known status, 46.2%, 38.0%, and 12.5% were declining, stable, and improving, respectively.⁹⁵ Excluding extinct species, this distribution of species status did not differ significantly from that of plants described in Table 3.⁹⁶ Among the animals, however, one sub-category of species, the clams, had a disproportionate impact on the summary statistics. Among the fifty-six listed clams species, only one was known to be stable or improving, while forty-seven were declining, three were extinct, and five had an unknown status. The percentage of clam species with a known status that were in decline (97.9%) was far greater than that of any other category of species.⁹⁷ With the clam species removed, the animals appeared to be in better condition than the plants; among the remaining 278 animal species

⁹⁰ See Jeffrey J. Rachlinski, *Noah by the Numbers: An Empirical Evaluation of the Endangered Species Act*, 82 CORNELL L. REV. 356, 375-76 (1997).

⁹¹ See *id.* at 376-77.

⁹² See *id.* at 377-78. Some animal species were listed before the 1973 amendments to the ESA implemented the protections described in this paper. These species were therefore protected for 21 years at the time of the 1994 FWS REPORT, although they had been listed longer than that.

⁹³ This correlation coefficient was statistically significant. $t(288) = 3.42, p < .001$. For a description of the statistical test involved in this analysis, see JACOB COHEN & PATRICIA COHEN, *APPLIED MULTIPLE REGRESSION/CORRELATION ANALYSIS FOR THE BEHAVIORAL SCIENCES* 52-53 (2d ed. 1983). Throughout this paper, the word "significant" denotes a statistically reliable finding in which the null hypothesis can be rejected at a probability of less than .05.

⁹⁴ This was determined by regressing a binary variable indicating whether a species was stable or improving, as opposed to declining, on the number of years a species has been protected. Regression analysis is described fully in COHEN & COHEN, *supra* note 93. The beta coefficient for the years of protection was .02.

⁹⁵ 3.3% of the animals were extinct.

⁹⁶ $X^2(2) = 0.14, p > .5$. The X^2 statistic is described in WILLIAM L. HAYS, *STATISTICS* 536-73 (3d ed. 1981).

⁹⁷ The following were the percentages of known species that were declining among the other groups of animals: mammals, 42.5%; birds, 35.4%; reptiles, 42.9%; amphibians, 50.0%; fishes, 38.0%; snails, 38.9%; crustaceans, 44.4%; insects, 38.9%; and arachnids were indeterminate (all four species had an unknown status). See Rachlinski, *supra* note 90, at 373-74 n.128.

with a known status, 37.8%, 45.0%, and 14.4% were declining, stable, and improving, respectively. This distribution (excluding the eight extinct animal species) was significantly different from that of the plants.⁹⁸ The animal species, however, had been protected longer than the plant species. Animals had been protected for an average of 13.2 years, as opposed to an average of 6.8 years for plants. This difference was statistically significant.⁹⁹ Once this difference was taken into account, the percentage of animal species that were stable or improving did not differ from the percentage of plants that were stable or improving.¹⁰⁰

2. *Land Ownership and Species Status*

Land ownership patterns influenced the status of plant species. Regression analysis revealed that the percentages of species habitat held by federal, state, or private landowners significantly predicted whether a species was stable or improving, as opposed to declining.¹⁰¹ A separate regression showed that the fourteen different landowner percentages also significantly predicted whether a species was stable or improving, as opposed to declining.¹⁰² Among those species that were stable or improving, the percentages of habitat held by federal, state, or private landowners did not significantly predict whether a species was improv-

⁹⁸ $\chi^2(2) = 6.16, p < .05$.

⁹⁹ $t(459) = 12.0, p < .001$.

¹⁰⁰ To determine the difference in status between plants and animals while controlling for the effect of the number of years that species had been protected, two regression equations were run and compared. The first regressed the species status (stable or improving, versus declining) on the number of years that the species had been protected; the second was the same except that it added a dummy code predictor variable identifying each species as a plant or animal. This addition explained no more variance in the dependent variable than the first regression and hence there was no difference between the percentage of plant species that were stable or improving and the percentage of animal species that were stable or improving aside from the difference in the length of time each type of species had been protected. This statistical technique is described in COHEN & COHEN, *supra* note 93, at 97-103, and it was used throughout this analysis to control for the effect of the number of years that species had been protected.

¹⁰¹ $F(2, 287) = 6.05, p < .005$. Because any combination of the two variables indicating percentage of habitat in federal, state, or private ownership uniquely determined the third variable, the regression equation included only two predictor variables. The regression predicted 3.4% of the variance in the dependent variable (adjusted). Controlling for the years that a species had been protected revealed that the two ownership variables independently explained 3.1% of the variance in the dependent variable, which was a significant increase. $F(2, 286) = 4.13, p < .05$.

¹⁰² $F(13, 274) = 2.02, p < .025$. The regression predicted 4.4% of the variance in the dependent variable (adjusted). Controlling for the years that a species had been protected revealed that the fourteen ownership variables independently explained 7.8% of the variance in the dependent variable, which was not a significant increase. $F(13, 275) = 1.56, p > .10$. This suggests that the detailed pattern of land ownership did not predict species status except inasmuch as it indicated which species had been protected longer. The effect could have run in the reverse direction, however (species protected longer were in better condition, in part, because they were more likely to be found on certain types of land).

ing, as opposed to stable, although this regression approached significance.¹⁰³ The fourteen different landowner percentages did not significantly predict whether a species was improving, as opposed to stable.¹⁰⁴

None of the individual beta coefficients for the ownership variables were significant in the regression equations predicting whether a species was stable or improving, as opposed to declining. The ownership variables, however, were necessarily inversely correlated—the greater the percentage of a species' habitat held by the federal government, the lower the percentage held by the states and by private parties. Thus, instead of analyzing the coefficients in the regression equations, the correlations between the ownership variables and whether a species was stable or improving, as opposed to declining, were directly assessed. Table 4 reports these correlations.¹⁰⁵

TABLE 4: CORRELATION BETWEEN THE PERCENTAGE OF HABITAT HELD BY EACH LANDOWNER TYPE AND WHETHER A SPECIES WAS STABLE OR IMPROVING (AS OPPOSED TO DECLINING) (N=290)

Federal Landowner	Correlation	State Landowner	Correlation	Private Landowner	Correlation
All Federal	.20*	All State	-.09	All Private	-.12*
BLM	.13*	State Preserve	-.05	Resid./Comm.	-.16*
USFS	.09†	State Park	-.07	Agriculture	.05
NPS	.01	State Misc.	-.02	Grazing	-.11†
NWR	.12*			Undeveloped	.08
DOD	.09			Private Reserve	-.02
Indian	-.04				

* statistically significant correlation ($p < .05$) † approached statistical significance ($p < .10$)

In Table 4, a positive correlation indicates that the more land held by that type of landowner, the more likely species were to be stable or

¹⁰³ $F(2, 144) = 2.80, p < .10$. The regression predicted 2.4% of the variance in the dependent variable (adjusted). Controlling for the years that a species had been protected revealed that the two ownership variables independently explained 4.3% of the variance in the dependent variable, which was a significant increase. $F(2, 143) = 3.31, p < .05$.

¹⁰⁴ $F(13, 133) = 1.56, p = .10$. The regression predicted 4.8% of the variance in the dependent variable (adjusted). Controlling for the years that a species had been protected revealed that the 14 ownership variables independently explained 12.3% variance in the dependent variable, which was not a significant increase. $F(13, 132) = 1.47, p > .10$.

¹⁰⁵ The fourteen variables indicating percentage of ownership obviously also correlated with each other; any one variable was equal to 100 minus the sum of the other 13. This was also true of the three composite variables (each of which was equal to 100 minus the sum of the other two). As such, each correlation coefficient overstates the unique ability of that parameter with the species status, but completely teasing aside the multicollinearity among the ownership variables was impossible.

improving, as opposed to declining.¹⁰⁶ Overall, the percentage of habitat held by the federal government correlated positively with whether species were stable or improving, as opposed to declining. Conversely, the percentage of habitat held by private parties correlated negatively with whether species were stable or improving, as opposed to declining. The percentage of habitat held by states and territories did not correlate with species status. Among the ownership sub-categories, the percentage of habitat held by the BLM and by a NWR correlated positively with whether species were stable or improving, as opposed to declining. To a lesser extent, the percentage of land held by the USFS and the DoD also correlated positively with whether species were stable or improving, as opposed to declining. On private property, the percentage of habitat subject to residential and commercial development correlated negatively with whether species were stable or improving, as opposed to declining. The percentage of habitat held as private grazing land showed a slight negative correlation with whether species were stable or improving, as opposed to declining. The percentage of habitat held by private trusts did not correlate with species status.

Among those species that were either stable or improving, the correlations between whether a species was improving, as opposed to stable, were assessed only for the three composite landowners because the more detailed pattern did not significantly predict this variable. The correlations were $-.01$ for the federal percentage, $-.17$ for the state percentage, and $+.15$ for the private percentage.¹⁰⁷

¹⁰⁶ To test whether the significant correlations were attributable to differences in the number of years that species on different types of land had been protected, a regression equation predicting species status (stable or improving, as opposed to declining) from the years that species had been protected was compared to regression equations that use both the years a species had been protected and the percentage of habitat in each ownership status. The percentage of habitat in federal ownership explained an additional 2.7% of the variance in the dependent variable, which was significant. $F(1, 287) = 8.30, p < .01$. The private ownership percentage explained an additional 1.1% of the variance in species status, which was marginally significant. $F(1, 287) = 3.32, p < .10$. Among the 14 individual variables, the percentage of habitat held by the NWR, residential and commercial land, and grazing land each explained a significant amount of variance independently of the number of years that species had been protected (2.5%, 2.9%, and 2.8%, respectively). $F(1, 287) = 4.55, p < .05$; $F(1, 287) = 5.78, p < .05$; and $F(1, 287) = 5.48, p < .05$, respectively. The percentage of habitat held by the BLM explained an additional 1.1% of the variance in the dependent variable, which was marginally significant. $F(1, 287) = 3.32, p < .10$. The percentages of land held by the USFS and the DoD explained only an additional 0.8% and 0.4% of the variance in the dependent variable, respectively. Neither of these increases was significant. $F(1, 287) = 2.41, p > .10$; $F(1, 287) = 1.20, p > .25$.

¹⁰⁷ The federal correlation was not significant, $t(146) = 0.25, p > .5$; the state correlation was significant, $t(146) = 2.08, p < .05$; and the private correlation approached significance, $t(146) = 1.78, p < .10$. Once the years that species had been protected was accounted for, the percentage of habitat held by the states and territories explained an additional 2.4% of the variance in the dependent variable, which approached significance. $F(1, 144) = 3.65, p < .10$.

Table 5 reports the distribution of species status by dominant landowner type.¹⁰⁸ The distributions of species status differed significantly between the three types of landowners.¹⁰⁹ Only 36.1% of those species that relied predominantly on federal land were declining, whereas more than half of the species that relied predominantly on state and private land were declining. Among species that relied predominantly on federal land, however, the percentage of species that were improving (15.3%) was comparable to the percentage of species that were improving among species that relied predominantly on private land (14.4%).

TABLE 5: SPECIES STATUS BY PREDOMINANT LANDOWNER

Status	Predominant Landowner Percentage and Number		
	Federal	State	Private
Improving	15.3 (11)	4.4 (2)	14.4 (22)
Stable	48.6 (35)	37.8 (17)	32.0 (49)
Declining	36.1 (26)	57.8 (26)	53.6 (82)
Total	100.0 (72)	100.0 (45)	100.0 (153)

Most of the land held by federal and state entities were used in different ways from land held by private parties, which might have accounted for the differences in the status of species. Completely controlling for the different uses of these lands was not possible because many federal uses, such as national parks and military bases, have no private analogs. Although USFS land is somewhat comparable to pri-

The percentage of habitat in private ownership explained an additional 3.5% of the variance in the dependent variable, which was also significant. $F(1, 144) = 5.38, p < .025$.

¹⁰⁸ Ties were removed from this analysis. For 48 species, two of the composite types of owners held equal amounts of land. Among these, 11 species had equal amounts of habitat on federal and state land, 10 had equal amounts of habitat on federal and private land, and 27 had equal amounts of habitat on state and private land. Most of these species had an unknown status, and hence their removal did not affect the analysis. Removing the ties, however, did remove nine species that were declining (one federal-state tie, two federal-private ties, and six state-private ties), 10 species that were stable (three federal-state ties, five federal-private ties, and two state-private ties), and one species that was improving (a federal-private tie).

¹⁰⁹ $X^2(4) = 10.4, p < .05$. Species with habitat that was predominantly federal were protected, on average, longer (8.03 years) than species with habitat that was predominantly state (4.96 years) or private (6.73 years). Once the years that species had been protected were accounted for, the dominant owner did not influence species status as being stable or improving, as opposed to declining. Two variables coded to indicate the dominant owner independently explained an additional 1.0% of the variance in the dependent variable, which was not significant. $F(2, 267) = 1.40, p > .10$. The dominant owner did, however, independently explain an additional 4.2% of the variance in whether species status was improving, as opposed to stable, once the years that species had been protected was controlled, which was significant. $F(2, 132) = 3.69, p < .05$. The beta coefficients in the regression were negative for the dummy codes identifying species that were found predominantly on federal and state land, which indicated that species found predominantly on private land were more likely to be improving, as opposed to stable, than were species found predominantly on federal or state land.

vately owned forest land, only a handful of species (all in Florida) had habitat in private forests. Nevertheless, some comparisons were possible; the analysis includes data on NWRs and private refuges, and on BLM land (which is primarily used for grazing) and private grazing land. As noted in Table 4, the percentage of habitat on a NWR correlated with whether a species was stable or improving, as opposed to declining, while the percentage of habitat on private wildlife refuges had no effect on this variable. The difference between these two correlation coefficients was not significant, although there was a strong trend.¹¹⁰ To sharpen the comparison between BLM land and private grazing land, BLM land-used as grazing land was identified from the Federal Register announcements.¹¹¹ As indicated in Table 4, the greater the percentage of habitat held privately as grazing land, the less likely a species was to be stable or improving, although the correlation ($-.11$) only approached significance. The amount of habitat held by the BLM and used exclusively for grazing correlated positively with whether a species was stable or improving ($+.10$), which also only approached significance.¹¹² Despite the fact that neither the private grazing nor the BLM grazing percentages correlated significantly with species status, these two correlation coefficients were significantly different from each other.¹¹³ Thus, in both cases where federal-private comparisons were possible, federal land was more beneficial to listed plant species than private land.

3. *The Effect of State Law on Private Land*

Among the 290 species with a known status, forty species were found predominantly in jurisdictions with statutes that prohibit private landowners from taking protected plants ("restriction" statutes), thirty were found predominantly in jurisdictions with statutes that require the landowner to notify a state agency before taking protected plants ("notice" statutes), eighty-five were found predominantly in jurisdictions with statutes that do not restrict landowners but prohibit others from taking species without a landowner's permission ("permission" statutes),

¹¹⁰ $t(287) = 1.62, p > .10$. The statistical test to determine whether correlation coefficients differ significantly is described in COHEN & COHEN, *supra* note 93, at 53-57. After controlling for the years that species had been protected, a regression analysis, including the percentage of habitat in a NWR and in a private refuge, explained an additional 1.5% of the variance in the dependent variable, which approached significance. $F(2, 287) = 2.28, p < .10$.

¹¹¹ Of the 61 species found on any BLM land, 50 were found on that used for grazing.

¹¹² $t(289) = 1.62, p = .11$.

¹¹³ $t(287) = 2.30, p < .025$. After controlling for the years that species had been protected, a regression analysis including the percentage of habitat held by private parties for grazing and by the BLM for grazing, explained an additional 2.4% of the variance in the dependent variable, which was significant. $F(2, 287) = 3.52, p < .05$.

and 135 were found predominantly in jurisdictions without any statutes protecting plants.¹¹⁴

Table 6 describes the status of species found predominantly on privately owned land under the four different types of state or territorial law. In those jurisdictions with restriction statutes, only 25.0% of species were declining, whereas in the other jurisdictions, 56.0% were declining. These two distributions differed significantly from each other.¹¹⁵ In those jurisdictions that do not restrict landowners, the distribution of species status did not differ significantly among species found in jurisdictions with the three different types of law.¹¹⁶

TABLE 6: SPECIES STATUS AMONG SPECIES FOUND PREDOMINANTLY ON PRIVATE LAND AMONG THE JURISDICTIONS WITH FOUR DIFFERENT TYPES OF LAWS

Status	State Endangered Plant Law				
	Restriction Statute	No Restriction Statute			
		All Jurisdictions Without Restriction Statutes	Notice Statute	Permission Statute	No Protection
Improving	8.3 (1)	14.9 (21)	7.1 (1)	21.0 (13)	10.8 (7)
Stable	66.7 (8)	29.1 (41)	35.7 (5)	32.3 (20)	24.6 (16)
Declining	25.0 (3)	56.0 (79)	57.1 (8)	46.8 (29)	64.6 (42)
Total	100.0 (12)	100.0 (141)	100.0 (14)	100.0 (62)	100.0 (65)

a. The Effect of Restriction Statutes

Table 7 reports the coefficients showing the correlation between the percentage of habitat held by private parties and whether a species was stable or improving, as opposed to declining, among the forty species in jurisdictions with restriction statutes and among the 250 species in the other jurisdictions. Table 7 also includes the results of a statistical test to determine whether the two correlation coefficients differed. Due to the small sample size, statistics are not reported for the relationship between the percentage of habitat held by private parties and whether a species

¹¹⁴ Included among these 135 species are two species in Virginia and 18 species in California that these states do not recognize as protected species.

¹¹⁵ $\chi^2(2) = 7.20, p < .05$. This trend could not be accounted for by the length of time that species found predominantly on private land had been protected, as the species in jurisdictions with restriction statutes were protected for less time on average, than species in other jurisdictions (4.2 years versus 6.9 years, respectively).

¹¹⁶ $\chi^2(4) = 5.52, p > .10$.

was improving, as opposed to stable, in the two different types of jurisdictions.¹¹⁷

TABLE 7: EFFECT OF STATE RESTRICTIONS ON PRIVATE LANDOWNERS ON CORRELATIONS BETWEEN PERCENTAGE OF HABITAT HELD BY EACH LANDOWNER TYPE AND WHETHER A SPECIES WAS STABLE OR IMPROVING (AS OPPOSED TO DECLINING)

Landowner	Correlation Between Percentage of Habitat Held by Each Landowner Type and Species Being Stable or Improving (As Opposed to Declining)		
	Unrestricted (n = 250)	Restricted (n = 40)	z statistic
All Private	-.14	.12	1.53
Resid./Comm.	-.21	.27	2.74**
Agriculture	.04	.20	1.65†
Grazing	-.09	-.22	0.77
Undeveloped	.09	.02	0.42
Private Reserve	-.02	.30	1.87†

† approached statistical significance ($p < .10$)

** statistically significant ($p < .01$)

The analysis revealed a trend for restriction statutes to mitigate the correlation between being on private land and being in decline.¹¹⁸ On residential and commercial land, which had the most adverse effect on species status, the correlation between the percentage of species habitat and species status (stable or improving, as opposed to declining) was reversed in jurisdictions with restriction statutes. The correlation between the percentage of habitat held in residential and commercial property and whether a species was stable or improving, as opposed to declining, was +.27 in those jurisdictions with restriction statutes, and was -.21 in those jurisdictions without restriction statutes. Agricultural land and land in private reserves also had different effects on species status in jurisdictions with restriction statutes than on species status in other jurisdictions without restriction statutes. Only grazing land showed the reverse trend, which was not significant.

¹¹⁷ Of the 40 species with a known status in jurisdictions with restriction statutes, 23 were found on any private land, and of these, only 13 were either stable or improving. Nevertheless, the correlation between the percentage of habitat in private ownership and whether a species was improving, as opposed to stable, was zero among species in jurisdictions with restriction statutes and +.17 among species in the other jurisdictions. This difference was not significant. $z = 0.69$, $p > .5$.

¹¹⁸ This trend could not be accounted for by the length of time that species had been protected, as the species in jurisdictions with restriction statutes had been protected for less time, on average, than species in other jurisdictions (4.5 years versus 4.8 years, respectively).

Two jurisdictions, Hawaii and Puerto Rico, provide a good test of the impact of restriction statutes on protected plants. Although both are tropical island ecosystems with high concentrations of endangered and threatened plants, they have different legal rules regarding these plants. Hawaii forbids private landowners from harming protected plants on their property, while Puerto Rico has no laws protecting endangered plants. As Table 8 shows, listed plants fare significantly better in Hawaii than in Puerto Rico.

TABLE 8: SPECIES STATUS AMONG SPECIES IN HAWAII
AND PUERTO RICO

Status	Jurisdiction	
	Hawaii	Puerto Rico
Improving	8.8 (3)	0.0 (0)
Stable	41.2 (14)	19.4 (7)
Declining	50.0 (17)	80.6 (29)
Total	100.0 (34)	100.0 (36)

Although fifty percent of Hawaiian species with a known status were declining, over eighty percent of Puerto Rican species with a known status were declining. The difference between these two distributions was significant.¹¹⁹ All fourteen species that relied predominantly on private land in Puerto Rico were declining, but in Hawaii three such species were declining, three were stable, and one was improving.¹²⁰ In Puerto Rico, the correlation between the percentage of habitat in private ownership and whether a species was stable or improving, as opposed to declining, was $-.36$, whereas in Hawaii it was zero.¹²¹

b. The Effect of Permission Statutes

Table 9 reports the coefficients showing the correlation between the percentage of habitat held by private parties and whether a species was stable or improving, as opposed to declining, among species found primarily in jurisdictions with permission or notice statutes and in jurisdic-

¹¹⁹ $X^2(1) = 8.41$, $p < .005$. Due to the small sample size and the absence of any improving species in Puerto Rico, this test had to be performed on whether a species was stable or improving, as opposed to declining, instead of using all three categories. After controlling for the number of years that species had been protected, a regression analysis, which included a binary variable indicating whether a species was Hawaiian or Puerto Rican, independently explained an additional 4.6% of the variance in species status (stable or improving, as opposed to declining), which was significant. $F(1, 67) = 4.04$, $p < .05$.

¹²⁰ When combining the stable and improving species, these two distributions were significantly different. $X^2(1) = 9.88$, $p < .005$.

¹²¹ These coefficients did not differ significantly, although there was a trend towards a significant difference. $z = 1.52$, $p = .13$.

tions without statutes protecting listed plants.¹²² Table 9 also reports the correlation coefficients between the percentage of habitat held by private parties and whether a species was improving, as opposed to stable, among the species found primarily in each of these two types of jurisdictions. Finally, Table 9 includes statistical tests indicating whether the two correlation coefficients differed significantly.

TABLE 9: EFFECT OF STATE LAW REQUIRING PERMISSION OF PRIVATE LANDOWNERS ON CORRELATIONS BETWEEN PERCENTAGE OF HABITAT HELD BY EACH PRIVATE LANDOWNER TYPE AND WHETHER A SPECIES WAS STABLE OR IMPROVING (AS OPPOSED TO DECLINING)

Landowner	Correlation Between Percentage of Habitat Held by Each Landowner Type and Being Stable or Improving (As Opposed to Declining)			Correlation Between Percentage of Habitat Held by Each Landowner Type and Being Improving (As Opposed to Stable)		
	No Protection (n = 135)	Permission (n = 115)	z statistic	No Protection (n = 64)	Permission (n = 60)	z statistic
All Private	-.25	-.03	1.81†	.33	-.07	2.25*
Resid./Comm.	-.27	-.15	1.03	.25	-.05	1.67†
Agriculture	-.08	.15	1.80†	-.02	-.03	0.04
Grazing	-.12	-.02	0.83	.25	-.16	2.29*
Undeveloped	.10	.08	0.17	-.05	.02	0.36
Private Reserve	.03	-.09	0.92	.25	.06	1.05

† approached statistical significance ($p < .10$)

* statistically significant ($p < .05$)

** statistically significant ($p < .01$)

The results reported in Table 9 indicate that permission statutes benefit species.¹²³ Overall, the analysis revealed a non-significant trend indicating that the correlation between percentage of habitat in private ownership and whether a species was stable or improving, as opposed to declining, was less negative among species in jurisdictions with permission statutes. This trend resulted primarily from the impact of agricultural land on species status, which showed a small positive correlation in those jurisdictions with permission statutes and a negative correlation in jurisdictions with no statutes protecting endangered plants. Perhaps more importantly, the analysis revealed a strong trend for private owner-

¹²² For this analysis, the species in jurisdictions with notice statutes were combined with the species in jurisdictions with permission statutes, as the notice statutes also forbid taking protected species from private property without the permission of the owner.

¹²³ This trend could not be accounted for by the length of time that species had been protected, as species in jurisdictions with permission statutes were protected, on average, for about as long as species in jurisdictions without any such laws (4.87 years versus 4.88 years, respectively).

ship of habitat to correlate with whether a species was improving, as opposed to stable, in jurisdictions with permission statutes.

c. The Effect of Notice Statutes

Table 10 reports the coefficients showing the correlation between the percentage of habitat held by private parties and whether a species was stable or improving, as opposed to declining, among species protected by the notice statutes in Arizona and California and among those species found primarily in the thirteen jurisdictions with permission statutes. Table 10 also reports the results of a statistical test indicating whether the two coefficients differed. Due to the small sample size, statistics are not reported for the relationship between the percentage of habitat held by private parties in the two different types of jurisdictions and whether a species was improving, as opposed to stable.¹²⁴

TABLE 10: EFFECT OF STATE NOTIFICATION STATUTES ON CORRELATIONS BETWEEN PERCENTAGE OF HABITAT HELD BY EACH LANDOWNER TYPE AND WHETHER A SPECIES WAS STABLE OR IMPROVING (AS OPPOSED TO DECLINING)

Landowner	Correlation Between Percentage of Habitat Held by Each Landowner Type and Being Stable or Improving (As Opposed to Declining)		
	Notification Required (n = 30)	Permission (n = 85)	z statistic
All Private	-.09	-.03	0.30
Resid./Comm.	-.11	-.16	0.21
Agriculture	.17	.14	0.09
Grazing	-.16	.01	0.75
Undeveloped	-.17	.11	1.30
Private Reserve	.16	-.16	1.43

As Table 10 shows, the notice statutes in California and Arizona did not change the impact of private ownership of habitat on species status.

California provides a good test of the effect of notice statutes because the state does not automatically protect federally listed species, and it has left seventeen federally listed species off of its own list of protected species. As Table 11 indicates, California's statutes had little effect on

¹²⁴ Only 30 species with a known status were protected by the California and Arizona notice statutes, and only 15 of these species were on private land. Six of these species were stable or improving.

federally listed plants in that state.¹²⁵ Once the length of time that species had been protected was accounted for, species that California protects were in worse condition than species that the State does not protect.¹²⁶

TABLE 11: SPECIES STATUS AMONG PROTECTED AND UNPROTECTED SPECIES IN CALIFORNIA

Status	Protection in California	
	Protected	Unprotected
Improving	20.7 (6)	14.3 (2)
Stable	27.6 (8)	50.0 (7)
Declining	51.7 (15)	35.7 (5)
Total	100.0 (29)	100.0 (14)

Among California species found predominantly on private land, two unprotected species were declining, one was stable, and one was improving; in comparison, eight protected species were declining, five were stable, and one was improving.¹²⁷ Among unprotected species in California, the correlation between the percentage of habitat in private ownership and whether a species was stable or improving, as opposed to declining, was $-.27$; the correlation among protected species was $-.13$. These two correlation coefficients did not differ significantly.¹²⁸ Species in California do not benefit from the State's notice statute.

d. Species on Wetlands

The analysis produced no evidence that private landowners destroy species on wetlands in order to avoid federal restrictions. As described in Table 12, wetland species were in significantly better condition than non-wetland species,¹²⁹ even among species found predominantly on private land.¹³⁰ The correlations between the percentage of habitat held

¹²⁵ $X^2(1) = 0.97$, $p > .5$. Due to the small sample size, this test had to be performed whether a species was stable or improving, as opposed to declining, instead of using all three categories.

¹²⁶ After controlling for the years that species had been protected, a regression analysis including a binary variable indicating whether the species was protected or not in California, explained an additional 11.3% of the variance in whether a species was stable or improving, as opposed to declining, which was significant. $F(1, 40) = 6.29$, $p < .05$. The beta coefficient for the binary variable indicating whether a species was protected showed that species were more likely to be declining if they were protected than if they were not.

¹²⁷ The small sample size precluded conducting a meaningful statistical test.

¹²⁸ $z = 1.13$, $p > .25$. The sample size was small, however, as only eight unprotected species and 15 protected species had any presence on private land in California.

¹²⁹ $X^2(2) = 6.96$, $p < .05$.

¹³⁰ $X^2(1) = 3.88$, $p < .05$. Due to the small sample size, this test was performed on whether a species was stable or improving, as opposed to declining, instead of using all three

by private landowners and whether a species was stable or improving, as opposed to declining, was $-.13$ among non-wetland species and $-.02$ among wetland species. These correlations were not significantly different.¹³¹

TABLE 12: SPECIES STATUS AMONG WETLAND AND NON-WETLAND SPECIES OVERALL AND AMONG SPECIES THAT RELY PREDOMINANTLY ON PRIVATE LAND

Status	All Species		Private Land Species	
	Wetland	Non-Wetland	Wetland	Non-Wetland
Improving	11.5 (3)	12.5 (33)	14.3 (2)	14.4 (20)
Stable	61.5 (16)	36.0 (95)	57.1 (8)	29.5 (41)
Declining	26.9 (7)	51.5 (136)	28.6 (4)	56.1 (78)
Total	100.0 (26)	100.0 (264)	100.0 (14)	100.0 (139)

C. DISCUSSION

The data described in this paper clearly support the hypothesis that restrictions on private landowners benefit endangered and threatened species. Although the FWS's land-use restrictions might create incentives to harm species in some cases, these restrictions have a net positive effect across all listed species. The data suggest that in the absence of land-use restrictions, private landowners do more harm than good to endangered and threatened species. Even if some landowners voluntarily preserve endangered and threatened species, the tendency of other landowners to destroy species habitat outweighs any benefit from these efforts.

Several parts of the analysis involved in the experiment support this conclusion. Plant species on private land generally fared much worse than plant species on federal land. This result is seen most directly in the comparison of BLM land and private grazing land; on land-used for similar purposes, species on federal land were better off. Furthermore, the greater the percentage of species' habitat that consisted of private land, the more likely that species was to be in decline, particularly if the land was subject to commercial or residential development. This effect was reversed, however, in those jurisdictions with statutes restricting private landowners.

categories. This effect could not be accounted for by the length of time that species had been protected, as the wetland species found predominantly on private land were protected for less time, on average, than the non-wetland species found predominantly on private land (5.6 years versus 6.9 years, respectively).

¹³¹ $z = .51, p > .5$.

Other types of statutes designed to protect plants had only a mildly beneficial effect. Permission statutes somewhat mitigated the adverse effects of private land ownership on species status. As shown in Table 6, however, the permission statutes did not prevent species found predominantly on private land from declining. Similarly, the data revealed that the innovative "notice" statutes in California and Arizona did not provide much benefit to plant species.

Land-use restrictions arrest species' decline, but they do not promote species recovery. Even in those jurisdictions that restrict private landowners, only a handful of species were improving. In jurisdictions with "permission" statutes, species that were at least stable tended to be improving more than in other jurisdictions. This result suggests that some landowners voluntarily protect endangered plants on their property, and that permission statutes assist them in their efforts.

The analysis also included an ambiguous result; overall, the condition of animal species was comparable to that of plant species. If the ESA's land-use restrictions benefit species, then plants should have fared worse than animals because such restrictions do not protect plants. Numerous differences, however, between plants and animals might explain this result. For example, this crude, inter-kingdom comparison did not account for the type of land that each kingdom relied on for habitat. Because of a lack of data, the ownership of animal species' habitat could not be identified with as much accuracy as the plants species' habitat. Therefore, a direct test of the effect of land ownership on animals was not possible. This result is ambiguous, however, because it also fails to support the alternative hypothesis that land-use restrictions harm species.

Another curious pair of findings in the analysis were the effects of state and territorial ownership of habitat and the effects of private habitat preserves. State and territorial ownership had little overall effect on species status; it was neither beneficial nor harmful. If states vary widely in their treatment of endangered plants, then this aggregate result is not surprising. Some states are interested in promoting growth while others wish to further conservationist goals. Lumping states together in this analysis might have obfuscated the effects of different attitudes with which states approach the issue of conserving endangered species. Private land trusts are likewise subject to other influences not controlled in the present analysis. If private conservation organizations direct their efforts towards those plants in the greatest danger of extinction, then it is not surprising that the species on their properties are declining overall, even if individual populations have stabilized on such land.

Although the analysis generally supports the hypothesis that restrictions on private landowners benefit protected species, alternative explanations for the observed pattern of data are also possible. First, as noted

earlier, species status is a suspect variable. The type of landowner might influence the FWS's determination of species status. For example, if the FWS believes that species fare better on federal land, then it might have been more likely to assign a species on federal land a stable or improving status than a species on state or private land. Furthermore, the FWS might assign a species a better status if it is found in jurisdictions that protect plants. Without a more objective measure of species status, such explanations cannot be dismissed.

Second, after a species is listed, additional populations of the species might be easier to find on public land than on private land. The present analysis uses the ownership of habitat at the time of listing, but the FWS determination of species status doubtless included all known species populations in 1994. The discovery of a thriving new population of a species after listing could lead the FWS to identify the species status as improving, even if the species has not actually improved. If such discoveries are more commonly made on federal land than on private land, then species on federal land would appear to be in better condition than species on private land, even in the absence of any real difference. This effect does not explain why species on private land in jurisdictions that restrict private landowners fared better than species in other jurisdictions. This phenomenon, however, could have resulted from jurisdictions with restriction statutes devoting more resources to finding populations of protected species. More detailed data on which sub-populations of plant species are thriving or failing is necessary to control for these effects.

Third, it is not entirely clear whether private landowners in jurisdictions without restriction statutes actually know that they are allowed to remove protected plants. The public rhetoric on the ESA often leaves the impression that the presence of listed plants on private property creates land-use restrictions. Some newspaper articles and a leading book on the ESA make this assertion.¹³² Comments submitted to the FWS, including comments by sophisticated organizations, in opposition to the listing of plants sometimes cite the prospect of land-use restrictions as a reason not to list a plant.¹³³ On the other hand, anecdotal evidence indicates that at least some developers are aware that listed plants do not generally create

¹³² See, e.g., MANN & PLUMMER, *supra* note 5, at 187 (describing efforts to avoid the restrictions on private landowners caused by the presence of an endangered plant); Erin Kelly, *As Senate Seeks Endangered Species Agreement, Some in House on Different Road*, GANNETT NEWS SERVICE, June 4, 1997, at ARC ("The Endangered Species Act . . . outlaws the destruction of endangered plants or animals on public or private land."); Daniel Sneider, *Endangered Species Act Proves to be a Survivor*, CHICAGO SUN-TIMES, Feb. 23, 1997, at 26 (describing the prohibition against "harm" in the ESA as applying to endangered plants).

¹³³ See, e.g., Endangered and Threatened Wildlife and Plants; The Plant, Water Howellia (Howellia Aquatilis), Determined To Be a Threatened Species, 59 Fed. Reg. 35,860 (1994) (cattleman's association expressed concern that listing a plant would interfere with grazing by private landowners on their property).

land-use restrictions.¹³⁴ If private landowners do not recognize a distinction in the law between listed plants and animals, then the results of these analyses must be the spurious product of some other effect.

Fourth, it is not clear that the conclusions of this analysis, which were drawn primarily from data on listed plants, would also apply to animals. It might be that plants are relatively unobtrusive, and do not create adverse incentives, even though animals do. Maintaining animal habitat might be more costly than simply avoiding the destruction of plants. Furthermore, some animals, such as wolves, grizzly bears, and prairie dogs, harm the economic interests of the owners of the land that they occupy, which might make landowners more inclined to eliminate them.

Finally, one jurisdiction heavily influenced the results of this analysis. Hawaiian species accounted for thirty-four of the forty species with a known status in jurisdictions with restriction statutes.¹³⁵ Any of the many differences between species in Hawaii and species in other jurisdictions, aside from the differences in endangered plant laws, might account for the generally stable condition of the Hawaiian plants. Plants in a similar tropical environment in Puerto Rico, however, did not do as well as the Hawaiian plants, which might be attributable to the difference in law. This result suggests that at least some of the stability in Hawaiian plants results from Hawaiian law.

Conclusions about the benefits of restricting private landowners should be made with these caveats in mind. No aspect of the data, however, supports the theory that restrictions on private landowners have a net negative effect on protected species. For example, in wetlands, where the ESA creates powerful incentives for landowners to eliminate listed plants, the analysis reveals no evidence of any adverse consequences attributable to land-use restrictions. Even if restrictions on private landowners create unwanted incentives, the benefits of such restrictions to protected plants apparently outweigh any harm that these unwanted incentives may inflict.

IV. CONCLUSIONS

Critics of the ESA present a solid theoretical case against imposing restrictions on private landowners as a way of protecting endangered species. Such restrictions make harboring protected species costly to private

¹³⁴ See, e.g., Jonathan Brinckman, *Golf Course Developers Hook Around Rare Plant*, PORTLAND OREGONIAN, June 12, 1998, at B4 (describing voluntary efforts by golf course designers to save a population of a listed plant).

¹³⁵ Three species were in Michigan, two were in Minnesota, and one was in Iowa. Although other plants grew in these and other jurisdictions with restriction statutes, these species either did not have a known status or only part of their habitat was in these jurisdictions.

landowners. Other than anecdotes, however, there is no evidence to support the conclusion that these restrictions actually harm species. They might be responsible for the ESA's failure to spur improvements in the condition of listed species, as landowners who do not currently harbor protected species ensure that these species cannot inhabit their property. But the FWS does not list a species because its populations are failing to increase; the FWS lists a species because its populations are crashing. Listed species have an immediate need for a stable habitat, which the ESA seems to provide. In short, the data support the conclusion that the ESA does what it says—it prevents the further destruction of the habitat of endangered and threatened species.

This conclusion implies that the likely consequences of eliminating the FWS's regulations restricting private landowners would be to drive more species into extinction. Even if some landowners would voluntarily protect species but for the prospect of federal regulation of their land, the present analysis suggests that many more landowners would use habitat in ways that harm listed species.

Finally, what of the plight of endangered and threatened plants? Most of the listed plants on private land outside Hawaii are sliding towards extinction without hope of rescue. Listing does little or nothing for these plants, except perhaps identify them to the landowner as a nuisance that has to be eliminated before a federal or state permit can be obtained. Altering the ESA or the FWS regulations to protect plants in the same way that animals are protected would be politically difficult. Even if it were possible, landowners would probably be able to rid their property of listed plants before any such change in the law took place. Thus, it seems unlikely that the law will change or even that such a change would be desirable. If many of the listed plants survive, it will be because of expanded federal, state, and private preservation programs.

Some commentators note that the failure to protect plants reflects an implicit societal decision that preserving plants is less important than preserving animals.¹³⁶ This decision effectively relegates the fate of many endangered plants to the preferences of private landowners. Ultimately, the fate of these plants will provide a continuing test of whether private landowners voluntarily accommodate endangered species. The analysis in this paper suggests that the outcome of this test will be a continuous stream of extinctions.

¹³⁶ See, e.g., John Copeland Nagle, *Playing Noah*, 82 MINN. L. REV. 1171, 1193 (1998).